

Mind Over Pain: How Mindfulness Meditation Rewires the Brain to Ease Pain

Meditation has long been regarded as a path to peace — but scientists are now discovering that it can also alter how the brain perceives pain.



Meditation can help people heal both mental and physical pain. (Credit: Unsplash)

"Keep calm, everything will be fine," I repeated to myself during the long flight from China to Manchester. However, my body signaled the opposite. A severe cold made my nose so stuffy that I could hardly breathe, and [the eustachian tubes could not be opened](#). The air in my ear is trapped, resulting in an imbalance in the pressure of the inner ear and the outer ear. As the plane

climbed up, my ear felt a sharp pain, as if someone had stabbed a needle in my eardrum. I tried to swallow and yawn to relieve stress, but it did not work. At the moment I was about to give up, I suddenly remembered a technique I heard on the podcast two weeks ago. It was meditation.

I closed my eyes and began to count every breath. I tried to divert my attention from the piercing pain and focused all my attention on my breathing. To my surprise, the pain did not disappear, but I gained the ability to coexist with it. At some point, I realized that I had completely stopped paying attention to it. After the plane landed, I could hardly believe what had happened. The pain had eased not through medicine, but through the act of paying attention to my breath. My goal is to investigate whether the effects of meditation are partly driven by the placebo effect or whether it can truly change the way the brain perceives pain. Understanding this distinction may help more people recognize mindfulness meditation as a non-drug approach to managing both acute and chronic pain.

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[Fadel Zeidan](#) is a Professor in the Department of Anesthesiology in the Center of Pain Medicine. When he volunteered at a pain treatment clinic, he had no idea the experience would [change the direction of his life](#). He met Chris, who is a 10-year-old boy suffering from complex regional pain syndrome (CRPS). It is a rare chronic disease. A slight touch can cause intense pain. Doctors were almost out of options. Zeidan decided to try some different methods. He taught Chris a simple meditation technique. It started with focusing on your breath and observing the sensation of pain rather than fighting against it. After several practices, Chris excitedly told Zeidan that his

pain seemed to be easing; it had become gentle and bearable. “This really surprised me, and it motivated me to go to graduate school to understand how mind-body approaches affect pain,” Zeidan said. From then on, this issue became the driving force for his lifelong research. Zeidan devoted himself entirely to the neuroscience of mindfulness, seeking to uncover how the mind can reshape the experience of pain.

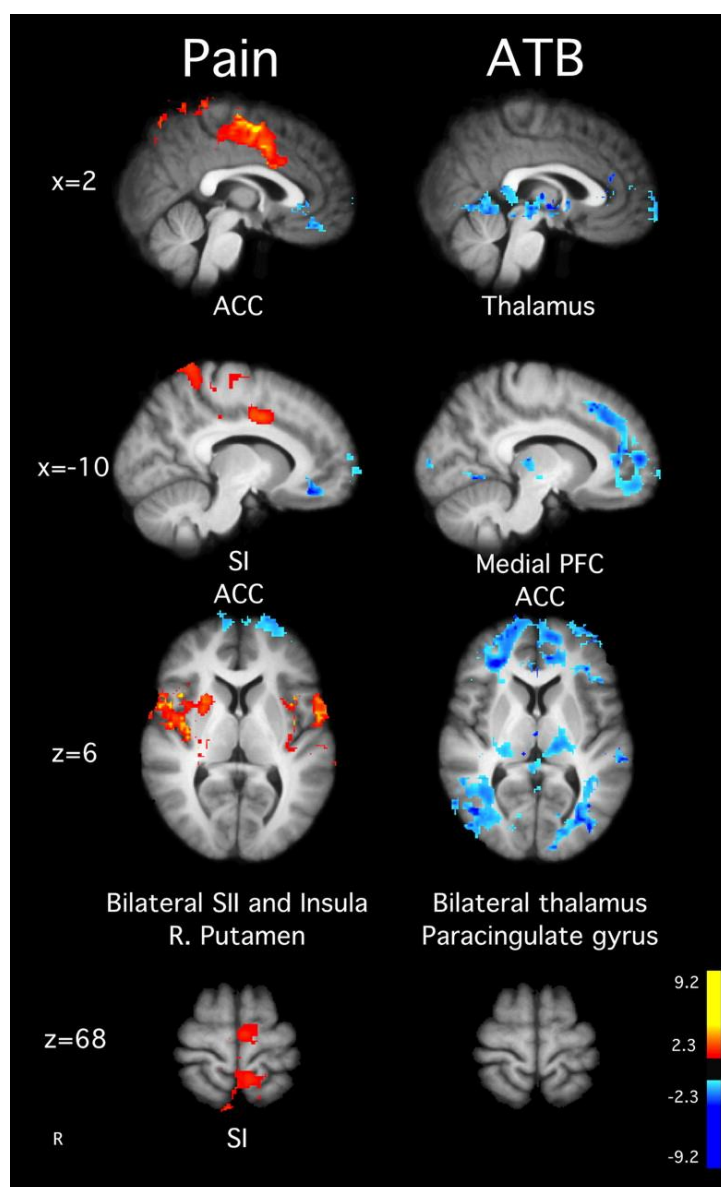
[Lara Hilton](#), the [Director](#) of the USC WorkWell Center, points out that “Chronic pain, often defined as pain lasting longer than 3 months or past the normal time for tissue healing, can lead to significant medical, social, and economic consequences, relationship issues, lost productivity, and larger health care costs.” As chronic pain affects around [21% of adults](#), it causes a loss of [\\$560 to \\$635 billion](#) in the United States every year. Relying on medication is not always an economically sustainable solution. For millions of adults balancing work, family, and long-term pain, an obvious question arises: Can mindfulness meditation really help?

Rewriting Pain in the Brain

[In the 2011 study](#), Fadel Zeidan and his colleagues invited 18 volunteers who had never practiced meditation before (15 completed the study). Over four days, participants spent 20 minutes per day learning basic meditation techniques. To give the highest chance of a meaningful result, the subjects had to match as closely as possible, with similar mental health status and pain tolerance. In the experiment, researchers tested volunteers under two different sessions. In both cases, participants experienced painful heat stimuli between 35°C and 49°C. It is hot enough to cause discomfort, but not severe enough to cause injury. Meanwhile, their brain activities and subjective pain scores were recorded using [brain imaging techniques](#).

During the first session, participants had not yet learned how to meditate. They rested with their eyes closed, relaxing and focusing on the sensation of

air passing through their nose. This is the control group in the study. After four days of mindfulness training, the same participants were retested. At this time, they entered the scanner in a state of true meditation. The results were clear. Researchers reported a 57% decrease in pain unpleasantness and a 40% reduction in pain intensity while meditating. Their brains did not shield the pain but reinterpreted the pain. Zeidan found that meditation changed the way the brain processes pain signals, transforming pain from a threatening experience into an acceptable feeling.



During painful stimulation (left), areas such as the Anterior Cingulate Cortex, Primary Somatosensory Cortex, and thalamus are highly active (in red),

signaling intense pain processing. During focused breathing meditation (right), these regions show decreased activity (in blue). (Credit: Zeidan et al., 2011)

Inside the Meditating Brain

In the state of meditation, various brain mechanisms respond to pain in distinct ways. First, the activation of the orbitofrontal cortex (OFC) helps to reduce pain. This area is responsible for assessing emotions and helping individuals redefine pain. As Zeidan recalls, "The subjects told us that they could still feel the pain, but they were able to let it go and realize that it was only a temporary sensation."

At the same time, the Anterior Cingulate Cortex (ACC) and the Anterior Insula (AI) are also activated. The Anterior Cingulate Cortex helps regulate attention and emotions, while the Anterior Insula enhances awareness of internal body signals. These two regions work together to shift the brain's attention from the pain itself to how it responds.

Finally, Zeidan often refers to the Thalamus as "[the gateway to pain](#)."

Meditation seems to shut the door to pain quietly. In other words, meditation decreases the activity of the thalamus, blocking the transmission of pain signals to higher brain areas.

Beyond the Placebo Effect

However, not everyone is convinced by these findings. In 2020, [Davies](#), a postdoctoral researcher at the University of Melbourne, and his colleagues argued that the pain-relieving effects of mindfulness meditation may partly reflect a placebo effect. The [placebo effect](#) refers to a situation in which a person's symptoms improve after receiving a treatment with no direct therapeutic action. The improvement comes not from the treatment itself, but

from the person's expectations, beliefs, and the context in which the treatment is given.

[In the study](#), the researchers designed a practice known as “sham meditation.” The purpose was to make participants believe they were practicing mindfulness meditation, without actually engaging the core mental processes that define mindfulness. Over 90% of participants in both the real and sham meditation groups were convinced that they were practicing mindfulness meditation. The study showed no significant difference in pain tolerance between the two groups. It raised a simple question: Is the pain relief linked to mindfulness meditation partly driven by placebo mechanisms?



Placebos can trigger real change in the brain through expectation and belief.
(Credit: Unsplash)

But Zeidan sees it differently. As early as 2015, his brain-imaging research found that mindfulness meditation, placebo treatments, and sham meditation activate different brain processing pathways when relieving pain.

In his [early experiments](#), participants in the “sham meditation” condition were also asked to sit quietly with their eyes closed and breathe slowly, but they were not guided to be aware of the present experience or adopt an unjudgmental attitude. The results showed that mindfulness meditation activated more brain systems involved in attention and emotional regulation, while placebo pain relief relies mainly on neural networks linked to expectation and belief. Sham meditation did not produce the same patterns of brain activity seen with mindfulness. These findings support that mindfulness meditation cannot be simply equated with the placebo effect.

Nevertheless, the debate did not end. Davies argued that the sham meditation used by Zeidan is similar to a genuine treatment. Participants sat with their eyes closed, followed guided instructions, and were told they were practicing meditation. That experience could trigger an expectation that the practice would help, making it hard to tell whether the pain relief came from meditation itself or from a placebo effect.

Zeidan responded with a [new study in 2025](#) that took a different angle. Rather than asking which method simply made pain feel less intense, he looked more closely at how different interventions changed the way the brain processes pain. The results found that mindfulness meditation not only reduced people’s subjective pain experience but also weakened the real pain signals and the negative emotions caused by pain. In contrast, placebo and sham meditation primarily influenced neural pathways associated with expectation. This finding does not deny the existence of the placebo effect but suggests that mindfulness meditation may have participated in the process of human coping with pain through a different brain path.

If you are living with pain, closing your eyes and taking a slow breath may help shift how it feels. By noticing the sensation rather than resisting it, you might discover that pain is less fixed than it first appears.

